Streamscape Inventory (SSI)

Technical Guide

Stanislaus National Forest

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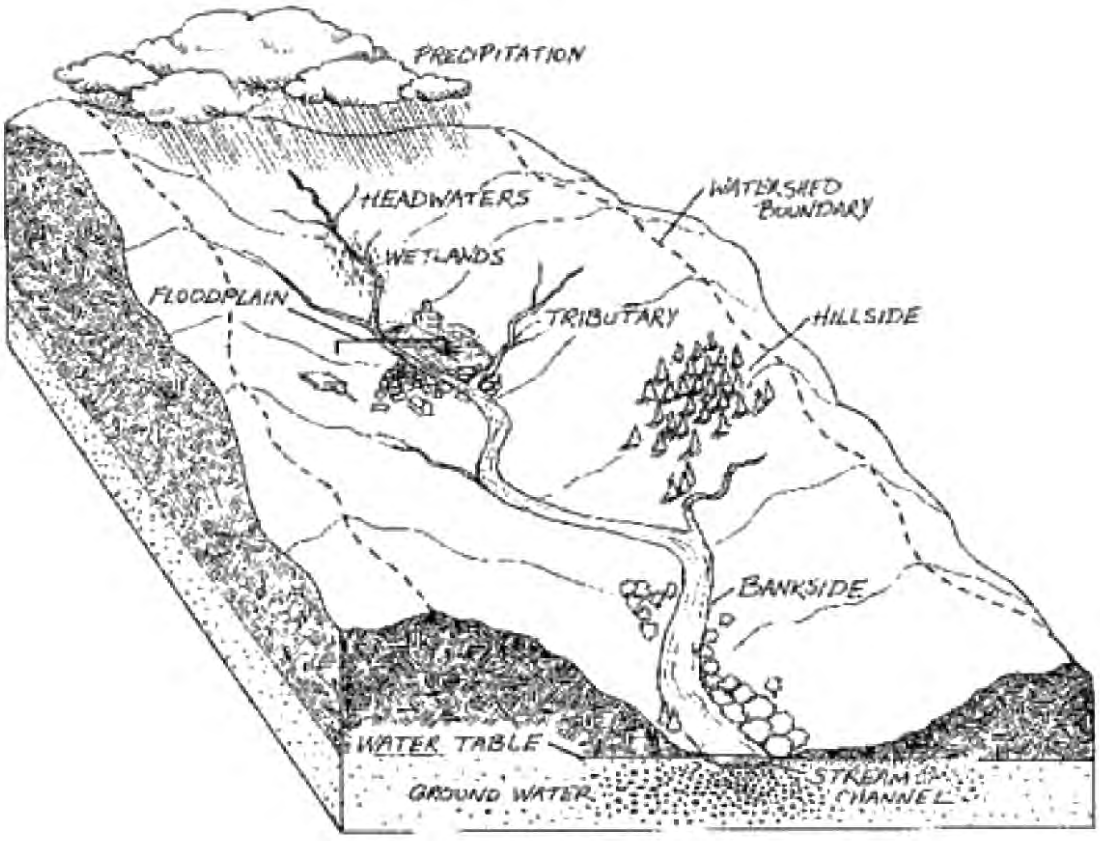

Table of Contents

I. PREFACE 3

II. INTRODUCTION 4

III. ATTRIBUTES & PROTOCOLS 7

1. ATTRIBUTES 7
2. PROTOCOLS 8
3. MEASUREMENTS TAKEN AT ALL TRANSECTS 8
   - *Water Surface Gradient 8*
   - *Stream Shading 9*
   - *Wetted Width 9*
4. MEASUREMENTS TAKEN AT SELECTED TRANSECTS 10
   - *Bankfull Width 10*
   - *Streamflow 11*
   - *Water Temperature 12*
5. MEASUREMENTS TAKEN BETWEEN TRANSECTS 12
   - *Pool Dimensions 12*
   - *Pool Tail Surface Fine Sediment 13*
   - *Pool Bed Surface Fine Sediment 14*
   - *Channel Form 15*
   - *Valley Form 16*
   - *Streambank Stability 17*
   - *Substrate 18*
   - *Large Woody Debris 18*
   - *Aquatic Fauna 19*
   - *Riparian Area Disturbances 20*
   - *Riparian Obligate Vegetation 21*
   - *Riparian Non-obligate Vegetation 23*
   - *Snags 24*
6. MEASUREMENTS TAKEN AT THE WATERSHED SCALE 25
   - *Water Quality 25*
   - *Benthic Macroinvertebrates 26*

IV. REFERENCES 27

V. APPENDIX - EXAMPLE FORMS 28

- *SSI Form 1: Transect & Channel Area Data 28*
- *SSI Form 2: Riparian Area Data 29*
- *SSI Form 3: Large Woody Debris & Aquatic Fauna Data 30*
- *SSI Form 4: Photo Log & Comments 31*

I. Preface

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Finally, recognition is extended to developers of the SSI Database in early 2008:

Sharon Grant, Forest Hydrologic Technician

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Tiering and References

This document tiers largely to the Stream Condition Inventory (SCI) Technical Guide, the first document referenced at the end of this guide. SCI contains numerous references for its protocols, many of which have been adapted for this guide. In addition, the SCI sections regarding Quality Assurance/Quality Control and Cleaning Survey Equipment are incorporated by reference into the SSI procedures.

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Frazier, J.W., S.J. Holdeman, S.L. Grant 2008. Streamscape Inventory Technical Guide. USDA Forest Service, Stanislaus National Forest, Resource Management Program Area. Sonora, CA.

Version 3.0 Update

Version 3.0 represents the first revisions of the Stanislaus Streamscape Inventory Technical Guide since Version 2.0 was published in June 2006. Version 2.0 was an update of Version 1.0 of 2005, the first year of the Stanislaus Streamscape Inventory. For text clarification and to incorporate recent improvements in SSI procedures, Version 3.0 includes revisions within the following attributes: Water Surface Gradient, Streamflow, Channel Form, Aquatic Fauna, Riparian Obligate Vegetation and Riparian Non-obligate Vegetation. In addition, data forms have been revised to match protocol changes and correspond with the SSI database developed this year.

II. Introduction

Application

The Streamscape Inventory (SSI) is a field extensive methodology for evaluating the existing condition of stream channels, aquatic resources and riparian areas. It is an integrated watershed-aquatic biology resource survey at the watershed level. Streamscape is applicable at multiple spatial scales, from projects to watershed analysis. This inventory may identify candidate stream reaches for more intensive surveys to determine if forest management practices and activities are in compliance with forest plan and/or watershed analysis objectives and guidelines. Streamscape is also an effective reconnaissance inventory for identifying Stream Condition Inventory (SCI) reaches (Frazier et al. 2005). SCI is a field intensive inventory to determine existing condition and monitor change over time.

As an extensive inventory, Streamscape is intended to gather information to characterize existing conditions over large areas in a time-efficient manner. As such, data collection methods include both quantitative measurements and ocular estimates. Training is provided for both so as to obtain consistency between observers and over time. Some attributes in Streamscape are identical or similar to SCI.

Streamscape is designed to be used on wadeable streams; that is, generally small perennial streams. Intermittent and even ephemeral channels may be inventoried depending on the purpose of the information collected. However, data necessitating water presence will be lost once these streams dry up following the winter season. Larger streams may be inventoried depending on objectives, and if it is safe to enter deeper and swifter water.

Background

Streamscape Inventory was developed on the Lassen National Forest in the late 1990's for use as Level 2 in a hierarchy of stream inventory procedures in the Pacific Southwest Region of the Forest Service. These levels are, in ascending order of intensity, Level 1 (Office Level), Level 2 (Field Extensive), Level 3 (Field Intensive) and Level 4 (Project Level). Each level utilizes components of the former level(s) as the specificity of effort increases. Streamscape has been utilized on the Lassen National Forest for Landscape Analysis and large-scale vegetation management projects.

The Streamscape inventory on the Stanislaus National Forest is conceptually identical to the Lassen National Forest procedure. Modifications to some of the attributes and protocols have been made to meet the needs of the Stanislaus National Forest.

Version 1.0 of Streamscape was prepared in June 2005 as the initial guide for conducting this type of inventory on the Stanislaus National Forest. Improvements to the guide have been made based upon field experience in summer 2005, and the product was—Version 2.0, June 2006.

Inventory Procedure

In general, SSI is initiated at the mouth of a stream and is conducted continuously upstream through the area to be inventoried. The inventory consists of measuring important stream, aquatic and riparian features, or attributes, along the stream using a standard protocol for each attribute.

Streams are stratified into reaches and each reach is subdivided by transects at 100 meter intervals. Thus, SSI incorporates a census and a systematic sampling approach to characterize information about stream channels and aquatic and riparian resources.

The inventory may be interrupted at locations along a stream where it is unsafe or where reasonable access does not exist. For example, it would be unreasonable to conduct the inventory where cliffs are encountered for the first 500 meters of a stream rising very steeply from its confluence with a large river.

Reaches

Reaches are designated primarily by stream gradient classes. The four gradient classes used in the Streamscape inventory are low gradient (<2%), moderate gradient (2-4%), steep gradient (4-10%) and very steep gradient (>10%). These correspond to the Rosgen Stream Classification system adopted by the Forest Service (Rosgen 1996).

Reaches may be segmented by landmarks within a gradient-class reach where usefulness is facilitated. For example, if a reach is crossed by a major road it may be broken at that point as a common place of reference.

Reaches have no maximum length. They may continue as long as the gradient class remains the same. The minimum length of a reach should be generally at least 200 meters. Gradient changes of about 100 meters, for example, are usually too short to consider meaningful at the field extensive survey level. For example, an 800 meter reach in the 2-4% gradient class may have a 100 meter distance that whose gradient is 5%.

Transects

Transects are spaced at 100-meter intervals along the stream, beginning at the start of each reach. The purpose of transects is to have systematic data sampling and recording sites.

It is important that a 100-meter interval is maintained for determining the location of each transect. A measuring tape or range finder may be used for maintaining even spacing between transects. Limited exceptions to the standard transect spacing may occur. For example, a headwater stream origin may be a spring that is only 60-meters upstream of the previous transect; or a private land boundary that prevents completion of a transect. In such cases, the transect length is noted on the data form. In addition, transects should not intersect pools but should be placed at the head or tail of the pool, whichever is closer to 100-meters.

Data Collection

There are three locations for data collection – at transects, between transects, and at the watershed scale.

1. At Transect Data – Six attributes are measured at all transect locations. These are best suited to a systematic sampling frequency of 100-meter intervals to characterize conditions over the reach and understand variability within the reach. The attributes in this category include water surface gradient, stream shading and wetted width of the stream.

   The three other attributes (e.g., bankfull width, streamflow and water temperature) are measured at selected transects because they generally do not change as often. Streamflow, for example, is recorded in flow classes that may vary only in the course of several miles. These attributes are measured at reach breaks and other selected transects according to the specific protocol for each.

2. Between Transect Data – These attributes are measured along the stream between transects. Some of these commonly occur intermittently (e.g., pools, large woody

debris) and some can be suitably characterized over a 100-meter segment (e.g. channel substrate, streambank stability, riparian vegetation).

3. Watershed Scale Data – Measurements may be taken at various watershed scales with the objective of a synoptic survey of existing condition. Water quality is one attribute that can be measured at various scales to provide baseline data if none exists. Sampling for benthic macroinvertebrates may also be conducted at the watershed scale. The appropriate watershed scale will depend on the objective of the survey. While the 5th field Hydrologic Unit Code (HUC) is generally too large for such synoptic surveys (40,000-250,000 acres), the 6th field HUC (10,000-40,000 acres) or the7th field HUC (2,000-10,000) may be more applicable. A combination of these may also be appropriate.

Data Recording

Between Transect data are recorded at the next upstream transect along with the At Transect data collected at that point. Thus, data are recorded at 100-meter intervals as the inventory progresses upstream.

The exception to the standard recording site is when riparian disturbance sites or other notable features are encountered between transects. These are usually identified, described and georeferenced at the location of occurrence. This allows site-specific information to be gathered about features that can be revisited based on GPS locations. Such sites may include notable sediment sources, locations of emphasis resource values that may not be identified by others (e.g., aspen stands, heritage sites).

The following notes apply to all data recorded:

- For purposes of this inventory, the left and right banks of the stream are referenced by viewing downstream.
- Circle all estimated quantitative data on the data sheet. For example, for a pool too deep to accurately measure, estimate the depth based on depths taken as close to the maximum depth as possible. Enter the estimated depth on the data sheet and circle the number.
- If no data are entered in a block on the form that would normally require data, place a dashed or diagonal line to indicate data was not overlooked.
- If there is a question about whether to record data, record it (“when in doubt fill it out”).

Units of Measure

Data are collected and recorded in a variety of units. For example, linear measurements (depths, widths) are metric, some calculated items are percentages (gradient, stream shading), volumetric measurement (streamflow) is in English units and water temperature is in centigrade.

III. Attributes & Protocols

The SSI consists of stream, aquatic and riparian area features, or attributes, useful for evaluating existing conditions. Attributes are used to indicate the character of these areas so that they can be compared with desired conditions or to assess compliance with management standards or guidelines. Table 1 describes each SSI attribute and its measurement location and method.

Each attribute has a protocol for field measurement. The protocol describes the attribute's importance, objectives and specific instructions on how and where to take measurements. The protocols are the keystone to the success of SSI since consistent data collection is important between observers and over time.

1. Attributes

Table 1. Streamscape Attributes

AT TRANSECTS		
Measurement Location	**Attribute**	**Measurement Method**
At All Transects	Gradient	Quantitative
	Stream Shading	Quantitative
	Wetted Width	Quantitative
At Selected Transects	Bankfull Width	Quantitative
	Streamflow	Quantitative/class
	Water Temperature	Quantitative
BETWEEN TRANSECTS		
Measurement Location	**Attribute**	**Measurement Method**
Pools	Dimensions	Quantitative
	Pool Tail Sediment	Quantitative
	Pool Bed Sediment	Quantitative
Channel Area	Channel Form	Ocular/class
	Valley Form	Ocular/class
	Streambank Stability	Ocular/class
	Substrate	Ocular/class
	Large Woody Debris	Tally
	Aquatic Fauna	Species/#/Size
Riparian Area	Riparian Area Disturbances	Type and Size
	Obligate Vegetation: Species/age/density	Species/Ocular/Class
	Non-obligate Vegetation: Species/age/density	Species/Ocular/Class
	Snags	Tally
AT THE WATERSHED SCALE		
Measurement Location	**Attribute**	**Measurement Method**
Flowing Streams	Water Quality	Quantitative
	Benthic Macroinvertebrates	Quantitative

Quantitative measurements are taken with some form of measuring device – a tape, depth rod, thermometer, etc.

Ocular estimates are made by viewing attributes and placing observations into a class defined system. Ocular estimates are calibrated by periodic field sampling to insure reasonable accuracy. There are three class defined systems used in this inventory. The first is based on the widely used classification system for streambed substrate. The second

is a numerical code for channel and valley form. The third is a quartile system used for riparian vegetation observations as well as streambank stability. Using a single such system improves efficiency and the accuracy of the ocular estimate.

Tallies are made for two attributes – large woody debris in streams, and snags in the riparian zone.

Species identification of aquatic fauna and major riparian area plants is made during the course of the inventory. For aquatic fauna, the size or size range and number of individuals is also recorded.

All attributes should be measured when doing the Streamscape inventory. However, selection of some attributes is acceptable depending on the objective of the inventory. For measuring an additional attribute that is not in the current version of Streamscape, a protocol should be provided for documentation.

2. Protocols

Protocols are procedures for conducting measurements of attributes. There is a protocol for each attribute, describing the importance, objectives and specific instructions on how and where to take measurements. The protocols are the keystone for success in gathering uniform information over time and space in watersheds of interest.

The protocol section to follow is divided into four sections regarding the location of measurements – at all transects, at selected transects, between transects, and at the watershed scale.

3. Measurements Taken at All Transects

Water Surface Gradient

Importance

Calculation of gradient is an important attribute for channel classification and, in Streamscape, for reach delineation. Knowledge of channel gradient can increase understanding of the geomorphic processes shaping the channel.

Objective of the measurement

To determine the stream channel gradient in percent slope in order to characterize the stream by gradient classes and determine reach breaks.

Where to take the measurement

Standing at the waters edge at each transect.

How to take the measurement

Sight a clinometer upstream or downstream to the height of another person equal with the eye level of the person doing the sighting. Both persons must be at water's edge when sighting. Sight for as long a distance as possible between the 100 meter transects. If it is not possible to view the entire 100 meters, take incremental gradient measurements and record the average on the data form.

Sighting may also be done between a person with a clinometer and a fixed object along the water's edge, such as a tree or boulder. Find a height on the fixed object the same as the eye level of the observer.

The product of the clinometer measurement will be the water surface gradient in percent. Record the gradient to the nearest whole percent and always as a positive number.

Refer to "Reaches" section on page 5 for delineation of reach breaks using gradient class.

Stream Shading

Importance

Stream shading may influence water temperature in some stream systems. Water temperature, in turn influences the health, behavior and survival of aquatic organisms.

Objective of This Measurement

Determine the average stream for the channel or reaches, and variability within the reach or channel length.

Where to Take the Measurement

In mid-channel at each transect.

How to Take the Measurement

Stream shading is measured using a Solar Pathfinder. At each sample location, level the instrument facing south at a height of approximately 30 cm above the water surface. Look for the reflection of the sky and objects providing shade on the instrument's dome, as viewed from no more than 15 degrees from vertical.

Use the August sun path. Add the shaded sections along the sun path to yield the percent shade for each sample. When totaling the shade numbers, observe the portion of each section that is shaded. Count fractions of individual sections that are shaded. Record the total amount of shade on the data sheet.

Wetted Width

Importance

The width of water-covered area of a stream helps define available aquatic habitat. Combined with stream depth and flow measurements, wetted width provides a general measure of the water volume. This information can be analyzed for variation along the stream and between streams.

Objectives of This Measurement

To characterize the width of the stream at the time the survey is conducted. This simple measurement produces a good picture of stream size, without which the character of the stream may not be well understood.

Where to Take the Measurement

At each transect.

How to Take the Measurement

Measure the width of the wetted surface of the stream channel using a tape measure or depth rod. Measure the width perpendicular to the direction of flow. Measurements are taken at fast water locations since transects are not split at pools. This provides a good characterization of stream width since fast water is the dominant habitat type, and there is width variation within fast water sections of the stream.

4. Measurements Taken at Selected Transects

Bankfull Width

Importance

Bankfull width in this inventory is important for determining a consistent stream width. This is useful for establishing a baseline stream size regardless of wetted width at the time of the inventory.

Objectives of This Measurement

Bankfull width is necessary to determine the length of wood to tally in the large woody debris count, and to estimate consistent stream width.

Where to Take the Measurement

At all reach breaks, and every 1600 meters for reaches that exceed that length. (Since bankfull width generally decreases moving upstream, it should be checked periodically on very long reaches). The measurement should be taken at the widest point of the fast water reach nearest the reach break where bankfull can be confidently identified. Look for more than one site with bankfull indicators to see if the measured one is representative of the general area.

To identify bankfull, look for the first flat depositional surface above the stream bed that corresponds to the elevation of the floodplain. Such depositional surfaces are most readily observed on low gradient streams and are often less evident in steep streams or in recently incised channels. When floodplains are not well defined, other indicators can serve as surrogates to identify bankfull stage. These include vegetation, changes in sizes of bank materials, and water stain or lichen lines on substrate. For example, the base of alders is an indicator of bankfull stage on moderate gradient streams, while willows may indicate bankfull stage on lower gradient streams. Often, bankfull stage can be validated by using more than one indicator – the base of alders may be at the same level as lichen lines and depositional surfaces.

How to Take the Measurement

Measure the width between bankfull with a measuring tape or depth rod. Make sure the location of the measurement is representative of the general area surrounding the reach break.

Streamflow

Importance

Streamflow is the basis for understanding the volume of aquatic habitat, presence and abundance of riparian vegetation, and is a general way to classify stream regimes.

Objectives of This Measurement

Characterizing the volume of flow in a stream at the time of the survey is important for relating water to presence and abundance of riparian vegetation and aquatic fauna.

Where to Take the Measurement

At all reach breaks, and every 1600 meters for reaches that exceed that length. (Since streamflow generally decreases moving upstream, it should be checked periodically on very long reaches). Conduct the measurement in a straight section of uniform flow as close as possible to the reach break or 1600 meters.

How to Take the Measurement

Streamflow (Q) is the product of cross-sectional area (A) of the wetted channel times the average velocity of flow (V). Thus, Q = AV.

For this inventory, use English units of measure to determine the flow in cubic feet per second (cfs).

The intent of this measurement is only to estimate the actual flow in the stream. It is not intended to be precise but rather just to get a basic understanding of the amount of water in the stream during this inventory. To do so, the “float” method is described below

To determine cross-sectional area, measure the wetted width in the section to be measured. Then take approximately 10 equally spaced depth measurements across the channel. Divide the sum of channel depths by the number of depth measurements plus 1 (for zero depth at one edge of the water). Multiply the wetted width by the average depth to get the cross-sectional area of flow. If the wetted width and depth measurements are taken in metric units, convert the cross-sectional area from square meters to square feet by multiplying by 10.8.

To measure velocity, float an object downstream for a fixed distance and divide by the time it takes to cover the distance. Repeat this in multiple locations across the channel to approximate the variation in velocity (generally 3 with a minimum of 2 and maximum of 5). Average the velocity measurements by multiplying the distance and travel time by the number of velocity measurements and then dividing distance by travel time. For example, if the distance is 10 feet and three velocity measurements are made that take 5, 7 and 3 seconds each to travel 10 feet, the total distance is 30 feet and the total travel time is 15 seconds. Divide 30 feet by 15 seconds; the average velocity is 2 feet per second. Multiply this value by 0.85 to account for surface tension of the stream surface.

Multiply the cross-sectional area times the velocity to determine streamflow. For example, if the area is 3.1 square feet and the average velocity is 1.8 feet per second x 0.85, the streamflow rate is 4.7 cubic feet per second.

Record the measured streamflow value and the streamflow class on the data form

Note: Although instream flow measurements as described above should be made at all reach breaks and 1600 meter intervals where applicable, estimates can be used whenever

there is high confidence that streamflow remains in the same flow class. For example, if at a reach break the result of an actual measurement is 1.7 cfs (flow class 1); upstream succeeding reach breaks are highly likely to remain in that class. In such cases, record 1.7 cfs on the data form at the next reach break, circle it to denote it's an estimate rather than a measurement, and record flow class 1 again. If an actual measurement is in flow classes 2, 3 or 4, estimates can be repeated until judgment shows that the flow class has decreased. Make sure to be as accurate as possible about flow class changes – when in doubt take an instream measurement.

Water Temperature

Importance

Water temperature strongly influences a stream's ability to support individual organisms, species populations and biological communities. Stream temperature affects health, behavior and survival of aquatic organisms.

Objectives of This Measurement

The objective is to characterize water temperature during the period of the survey. Since this is an extensive survey, the purpose is to gain a general understanding of daily water temperatures along the length of a stream as well as diurnal variation.

Where to Take the Measurement

Take a temperature measurement at each reach break and every 1600 meters on reaches longer than that. In addition, take a temperature measurement twice daily regardless of location. The first should be taken as early as possible in the morning to capture the daily low temperature, and the second should be taken in the late afternoon to portray the daily maximum. The combination of fixed locations and times for taking water temperature will help characterize water temperature in each watershed surveyed.

How to Take the Measurement

Place a thermometer in the fastest portion of running water nearest the measurement location (reach break, 1600 meter intervals, etc.). Hold the thermometer in the flow until the temperature stabilizes. Make sure that the probe is in water only (not touching streambed sediment, etc.)

5. Measurements Taken Between Transects

Pool Dimensions

Importance

Pools are an important component of habitat for aquatic organisms. Pools provide habitat complexity, deep water and cool summer temperatures, winter refuge, and areas for rearing of fish. They are also important indicators of channel morphology.

Objectives of This Measurement

The objectives are, 1) to quantify the number of primary pools in the stream, 2) to determine residual pool depths within the stream, and 3) to determine pool frequency in the stream.

Where to Take the Measure

Sample every primary pool in the reach.

Criteria for Determining Pools:

- Flow – Slow or no velocity during summer low flows.
- Morphology – Hydraulic control at pool tail, usually a concave longitudinal profile.
- Dimension – Dominant feature occupies most of stream width and includes thalweg (backwater and sidewater pools are not measured). Length is greater than wetted width. Depth is greater than non-pools. Maximum depth is more than twice pool tail depth. (Exceptions to these criteria can be found. These units should be considered pools if criteria described above are present).

How to Take the Measurements

- Pool depth – Measure the maximum depth of the pool using a depth rod. Estimate the depth if it is unsafe or otherwise difficult to measure the pool precisely.
- Pool tail crest depth – Measure the deepest point in the channel cross-section at the downstream end of the pool where the water breaks from smooth to turbulent flow.
- Pool Length – Measure the total length of the pool, from pool tail crest to the head of the pool, using a depth rod or measuring tape.

Pool Tail Surface Fine Sediment

Importance

Watershed and streambank disturbances often result in increased erosion and sediment input to streams. An excessive amount of fine particles in stream substrate have been shown to impair aquatic food production, decrease survival of young trout and alter benthic invertebrate populations.

Objective of This Measurement

To quantify the percentage of fine sediment on pool tail substrate.

Where to Take the Measurement

Take the measurement of fine sediment at the first pool upstream of each transect within a reach, and every third pool thereafter between transects. For example, if there are three pools between transects, measure fine sediment at the first pool only. However, if there are five pools between transects, measure the first and fourth pool. If there are seven pools, measure the first, fourth and seventh.

How to Take the Measurement

At each pool tail, stand immediately downstream of the pool tail crest. Estimate the downstream most 10% of the pool length (e.g., 1-meter in a 10-meter pool). The first measurement is taken in the thalweg within the 10% zone; the second measurement is taken midway between the thalweg and left waters edge; the third measurement is taken midway between the thalweg and right waters edge.

Within each of the three locations described above, make a random toss of the grid described below. To do so, avert the eyes and toss the grid into the prescribed area.

The grid is a 14-inch square of metal with a uniformly spaced mesh that forms 49 intersections. Counts are made of fine sediment beneath the intersections plus one corner of the metal grid to achieve a total of 50 counting locations. Each intersection has a value of one; in other words, only one count can be made at each intersection.

Count and record the number of points of substrate 2 millimeters or less. A viewing tube or dive mask can aid in viewing the grid by breaking the water surface glare and turbulence.

Since there are 50 counting locations, multiply the number of points where fines were observed times 2 to obtain the percentage of pool tail surface fines per grid toss.

NOTE: Do not overlap tosses in narrow streams. If only two tosses are possible, divide the stream in half and randomly toss the grid once in each half (i.e., left and right). If only one toss is possible, throw the grid in the thalweg.

Pool Bed Surface Fine Sediment

Importance

Excessive sediment can decrease the available storage capacity of pools in a stream. Pools are a preferred habitat in streams for many organisms and thus serve as an important component of habitat quality.

Objective of This Measurement

Estimate the amount of fine sediment in pools to determine the relationship between pool length and fine sediment length in the survey reaches.

How Many Measurements to Take

Take one measurement in each pool.

Where to Take the Measurement

Observe the entire area of the pool below the elevation of the pool tail crest (as if the water depth was zero at the pool tail crest). Within this area – including the pool tail - determine if a lens of fine sediment is present.

How to Take the Measurement

If a lens of fine sediment is present, measure its total length within the pool, including separate sections where there are interruptions such as boulders or logs. A lens is defined as a continuous deposit of fine sediment anywhere along the longitudinal profile of the pool below the pool tail crest. A fine sediment lens is defined as sediment on the pool bed that is dominated by particles 2 mm or smaller. Some particles up to 8mm may be part of the fine sediment matrix.

Channel Form

Importance

The cross-sectional shape of a stream channel is an indicator of its condition, and this form feature can be used as a criterion in stream classification. While all streams are incised into the landscape they occupy, their depth and width – principal attributes of shape - can be an important factor in understanding current condition and causative processes or management activities.

Objective of This Measurement

Determine the form of the channel throughout entire survey reaches.

How Many Measurements to Take

Take one measurement per 100 meters (between each transect).

Where to Take the Measurement

Continually observe the shape of the channel while surveying between each transect.

How to Take the Measurement

At each transect, record the class that best describes the channel form. The channel form classes are as follows:

1. Normal – No active downcutting or obvious evidence of accelerated past incision. This channel form can occur in all channel types but is most common in channels resistant to incision, such as where the streambed and banks are armored by cobble, boulder or bedrock. A normal channel is one viewed as not excessively incised into the landscape. Channel morphology is within the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, and bank angle). Streambanks and streamside areas are usually well vegetated and/or have cover resistant to erosion (e.g., boulders or bedrock, tree or shrub roots, large embedded wood in streambanks).
2. Incised – Active downcutting or evidence of accelerated past incision is present. This condition is most common in low gradient reaches where finer textured bed and bank materials are present, although steeper gradient sections with small substrate can have this same appearance. These stream segments appear gullied, and have lost connection with their former floodplain. They are usually narrow, single thread channels that have not yet “bottomed out” at a new base level. Channel morphology is altered from the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, and bank angle). They often have over-steepened channel slopes with poor streambank stability (lack of ground cover).
3. Incised and widened – These channel segments have bottomed out and subsequently widened. They have not developed a new floodplain. The channel may be braided in some areas. There is often little or no pool formation. Channel morphology remains altered from the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, and bank angle). They often have over-steepened banks and insufficient ground cover on the streamside slopes.

4. Rejuvenating – These are channel segments that have downcut and widened in the past but are currently reforming or have reformed into a stable channel at a new, lower base level. Rejuvenating channel segments usually occur in low or moderate gradient reaches with relatively small streambed particle sizes. Rejuvenation is evidenced by increasing floodplain and meander pattern redevelopment, and increasing pool formation. Channel morphology has returned to or is approaching the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, and bank angle). The over-steepened slopes adjacent to the channel from the initial incision are in the process of sloping toward the angle of repose, and re-vegetation is occurring on at least some these locations.

Valley Form

Importance

Valley form often indicates the process of channel formation and sensitivity to disturbances.

Objective of this Measurement

Determine the general valley form to recognize natural segmentation of reaches along a stream course.

How Many Measurements to Take

Take one measurement per 100 meters (between each transect).

Where to Take the Measurement

While surveying between each transect continually observe the valley form. Observe the steepness of the surrounding slopes and the width of the valley adjacent to the stream.

How to Take the Measurement

At the end of the 100-meter distance since the last transect, record the valley form class that best describes the land adjacent to the channel area. The valley form classes are as follows:

1. Narrow – This form is usually associated with steep gradient channels that have steep sideslopes rising directly or very near the edge of the channel.
2. Moderate – This form is usually associated with moderate gradient channels that have moderate sideslopes that rise near the channel.
3. Broad alluvial, herbaceous dominated – These are usually meadows – wide valley segments that are formed by deposition of fine-grained alluvium. Stream gradient is low and meandering is present. Valley width may vary from approximately 10 bankfull widths to several hundreds of meters. Herbaceous species such as carex and grasses dominate the vegetative cover although there is often a presence of obligate shrubs and trees. Conifers may be present but this valley form should be considered herbaceous dominated if there is a notable cover of perennial herbaceous species and obligate shrubs and trees.
4. Broad alluvial, conifer dominated – These valley segments are similar in size and formation to Class 3 but have developed a dominant vegetative cover of conifers. This often results from past downcutting that has lowered the water table and allowed conifers to outcompete herbaceous plants. There may be remnant obligate trees in the

conifer stands, often suppressed or dead. A conifer dominated alluvial flat will usually have little or no presence of perennial herbaceous plants.

Streambank Stability

Importance

Channel stability is an important indicator of the bank's susceptibility to erosion. Erosion may cause channel morphology alteration and excessive sediment deposition, which in turn affects aquatic habitat and fluvial processes.

Objective of the Measurement

The objective is to characterize the stability of streambanks along the channel.

Where to take the Measurement

Observe the full length of the streambanks on both sides of the channel while walking between each transect. Streambanks are the slopes immediately adjacent to the channel bed and extend upward to the crest of the first convex slope above bankfull stage or twice maximum bankfull depth, whichever occurs first. (The former usually occurs where the stream gradient is less than 2%).

Streambank stability is a measure of cover that protects streambanks against erosion. This cover consists of perennial vegetation, rock, down wood, or similar erosion resistant material. Cover most commonly occurs above the bankfull stage of stream channels. However, vegetative cover can exist below this level. For example, live plants often grow slightly below bankfull stage along low gradient streams with fine textured streambanks.

How to Take the Measurement

After observing the streambanks throughout the area between transects, rate streambank stability by placing the amount of stabilizing streambank cover into a quartile class. This includes combining the stabilizing cover on the banks on both sides of the stream. To do so, first decide if streambank stability over the 100-meter distance is more or less than 50%. Next, divide that in half to determine the quartile class (e.g., <25%, 25-50%, 50-75%, >75%).

Stabilizing cover components include

- Live Plants – (1) Perennial herbaceous species, such as grass-sedge-rush; (2) woody shrubs (willows, etc); (3) broadleaf trees (cottonwood, aspen, alder, etc.); (4) conifer trees, and (5) plant roots that are on or near the surface of the streambank and provide substantial binding strength to the substrate beneath.
- Litter/duff – Litter and/or duff at least 1" deep may count as cover if it is firmly affixed to the soil on streambanks. Litter consists of leaves, conifer needles and small twigs on the forest floor. As this material decomposes it becomes known as duff beneath the surface of newly accumulated litter. The combination of litter and duff can be an effective ground cover.
- Rock – Boulders (>256mm), bedrock and cobble/boulder aggregates when combined as a stabilizing mass.
- Down Wood – Logs that are firmly embedded into stream banks resist erosion and can be counted as cover.

Substrate

Importance

Inorganic material in the active stream channel is an indicator of the erosive forces of water and watershed sediment transport and deposition processes. The array of particle sizes in the channel, from bedrock to silts and clays, reflects watershed character and condition. This is a substantial factor in aquatic and riparian status and trend.

Objectives of This Measurement

The objective is to characterize the particle size distribution in the stream. This can be used to help classify streams and make inferences about condition.

Where to Take the Measurement

Observe the particle sizes in the channel while walking between transects. Record the dominant and subdominant particle size classes at the end of each transect.

How to Take the Measurement

While walking between transects, note the channel material size classes present (bedrock, boulder, cobble, gravel, sand, fines). Observe which two are the most dominant, then which of those is most frequent. In that order, record them on the data form.

Since particle size distribution may change between transects or reaches, calibrate the accuracy of the substrate characterization by conducting periodic particle counts. To conduct the particle count, walk a zigzag path between bankfull left and right. Count particles at a spacing at least equal to the largest size of particles in the channel. Avert the eyes and count the first particle touched at the end of the foot. Count at least 100 particles, making sure at least one full fast water-slow water sequence has been traversed. The most frequently encountered class is the dominant and the second is the subdominant. (A subdominant class must contain at least 10% of the total particle sizes in each transect to be counted. For example, if a gravel-dominated transect has only about 5% of larger sizes, do not enter a subdominant size class).

When measuring a particle, measure the intermediate, or “B” axis. This is the axis of the particle that is neither the shortest nor the longest dimension.

Large Woody Debris

Importance

Large wood is important in the morphology of many streams. It influences channel width and meander patterns, provides for storage of both sediment and bedload and is often the most important source of pool formation in small streams. Large wood is also an important component of instream cover for fish, as well as providing habitat for aquatic insects and amphibians. Large wood is part of the nutrient cycling process of aquatic species.

Objective of This Measurement

To quantify the frequency of woody debris in the stream reach.

Where to Take the Measurement

Between each 100-meter transect, count all wood that meets the criteria below, has a portion of its length within the bankfull channel, or are spanning the channel.

How to Take the Measurement

- Single Pieces – Tally each piece of dead and down wood longer than ½ bankfull width that has at least a portion of its length within bankfull. Pieces may be submerged in the channel, laying on the bed or spanning all or part of the channel. All wood greater than ½ bankfull width may be considered large wood since its diameter is usually proportional to its length.
- Aggregates – Tally all aggregates of large wood that are encountered. An aggregate is defined as four or more pieces of large woody debris in contact with each other. Count the number of pieces in the aggregate and record this number in the aggregate box on the data form. If there are multiple aggregates per transect, count pieces in each aggregate and record in the column for that transect.

Aquatic Fauna

Importance

Stream fauna is a key indicator of aquatic condition. The presence and distribution of aquatic biota is useful for management considerations.

This attribute is intended to identify basic aquatic biota information about species in or adjacent to the stream. It is not a "protocol" survey but may serve as the basis for conducting more intensive surveys. Surveys such as this are sometimes the only record of presence of some aquatic species.

Objective of the observation

To collect information on the presence and distribution of aquatic vertebrates in the survey reach.

Where to make the observation

While walking between transects, search for aquatic fauna.

How to make the observation

Conduct an ocular survey of the stream and near-shore area while gathering other data between transects. Identify the organisms to the lowest identifiable taxonomic level (usually species), and record their life stage, size class, and habitat type where they were found.

- Fish – Survey for fish by observing pools and fast water habitats. In addition, look at stream margins for young of the year (fry). Record all species observed and the number and size range of each, and record the number of young-of-year observed.
- Amphibians and Reptiles - Search for frogs, salamanders, aquatic/riparian snakes, and turtles. Look ahead while walking upstream since these species will often move quickly to cover when approached. Search in all potential habitats – in-stream, seeps, springs and ponds adjacent to the streams, etc.

Note: Record uncommon or rare terrestrial species observed (e.g., marten, bald eagle), or uncommon aquatic species such as freshwater clams.

Riparian Area Disturbances

Importance

Near-stream disturbances can lead to stream pollution, alteration of channel morphology, solid waste accumulation. It is important to document all relevant disturbances during the Streamscape Inventory since such items are not likely to otherwise be observed.

Objective of this Measurement

The objective is to identify locations of existing human or naturally occurring pollution sources or other unusual disturbances that might compromise water quality or other stream and riparian attributes.

How Many Measurements to Take

Record all discreet disturbances that meet the guidelines below.

Where to Take the Measurement

Observe for disturbances above streambanks while surveying between transects.

How to take the Measurement

Identify disturbances, record the type, size, and GPS location. Follow the guidelines below.

Disturbance types:

1. Bare Slope – Record locations between transects where bare slopes occur above streambanks. These are areas with little or no stabilizing ground cover adjacent to the channel. Such bare areas may extend upslope about 1 meter to tens of meters. They may be surface erosion, channel erosion, debris flows, landslides, etc. They may be natural occurrences or indirect or cumulative effects of management activities. When such disturbances are observed, estimate the total length and average height, in meters, on the data form. If a disturbance occurs on both sides of the channel combine into one total length and height. Describe the disturbance in the column provided and continue comments on the following form if needed.
2. Unclassified Road – These are roads that do not have a classification system number. They may have been classified roads, or user created. (Note: classified roads are recorded as part of the roads survey).
3. Landing/Skid Trail – Record the occurrence of landings and skid trails in the riparian zone that are current sediment sources. Many old landings and skid trails have re-vegetated or accumulated cover such that they are no longer a sediment source.
4. Motorized Trail – OHV trails that are sediment sources meeting the size guidelines should be recorded since they are not accounted for otherwise.
5. Non-motorized Trail – Same as for #4.
6. Dispersed Recreation Site – These are user-created sites that are adjacent to streams where day use or camping occurs. Record such sites that meet the size guidelines and may be sediment sources.
7. Developed Recreation Site – These are sites developed and maintained by the Forest Service. Record such sites that meet the size guidelines and may be sediment sources.

8. Grazing – Record locations of livestock trampling and chiseling on streambanks as well as nearby trailing that may be sediment sources.
9. Other – This category can include such items as solid waste dumps, hazardous materials deposition, pollutants other than sediment, etc.

Size Guidelines:

All disturbances in types 1-7 above should be recorded if they are singularly or cumulatively larger than approximately 50 square meters per 100 meters of stream length (the distance between transects). For example, this would be 25% of the length of both sides of the channel between transects for a streambank disturbance extending one meter above the streambanks. Or it could be a two-meter wide skid trail or unclassified road that is a sediment source upslope at least 25 meters.

Smaller sites may be recorded if they pose a substantial on-going problem. Otherwise, small occasional patches of disturbance (e.g., barren slopes) can be disregarded where they do not add up to about 50 square meters between transects.

For disturbance type 8, grazing, record livestock disturbances that show excessive evidence of streambank erosion that are causing vegetation damage and/or physical breakdown of soil. Near-stream livestock trails following the channel should be included when they are a sediment source. Occasional trails to water or parallel to the stream that are the minimum for livestock management may be disregarded.

For disturbance type 9, there is no minimum size guideline.

GPS Guidelines:

Record UTM coordinates of the approximate center point of disturbed area.

Disturbance Description Guidelines:

Describe any disturbance encountered as fully as possible, and photograph where applicable Use additional note space on the forms as needed. This is important since some sites will be revisited to determine potential management practices to address single or multiple disturbances.

Riparian Obligate Vegetation

Importance

Riparian vegetation that needs saturated soil conditions at least part of the growing season performs numerous ecological functions along streamcourses. This vegetation includes an array of herbaceous, woody shrubs and trees that provides shade for maintaining cool water temperatures, serves as host for insects that become food for fish, and offers streambank cover for aquatic biota. Robust riparian vegetation is an indicator of good stream health.

Objectives of This Measurement

The objective is to characterize the amount, type and size of riparian vegetation along streams.

Where to Take the Measurement

Identify obligate riparian species along the stream throughout the distance between 100-meter transects. While most obligate riparian vegetation will originate near bankfull and occupy a relatively narrow strip along the stream, make observations well into the riparian

zone since some obligate riparian vegetation may be present some distance from the channel.

Focus the observations on obligate riparian woody shrubs and trees. Herbaceous plants that typically exist along streams through meadows are not recorded on this part of the form. They are accounted for in the streambank stability rating and during other meadow assessment surveys outside the scope of Streamscape.

How to Take the Measurement

While walking between each transect, observe all obligate species present as well as their age and density. At the end of each transect on the survey, record the obligate species and the age and density class observed during the 100 meters just walked. See the species list and age/density class definitions on the data form. Note that there is an "other" species code listed; if such a species is encountered enter "O", get the species identified and record its name on the comment form (Form 4).

Riparian obligate species are categorized into three age classes, as follows:

1. Young – Seedlings, sprouts and young plants. Young plants are often seen as are shorter, younger age class compared to taller plants of the species. There should be approximately fewer than 10% of mature plants in this class for it to be designated young.
2. Diverse – A mix of young and mature age classes, with at least about 10% of one or the other (although there will be generally a more even distribution over the 100-meter distance between transects). Mature plants will exhibit taller form and may have dead branching under the crown that show the plants are continuing to grow. Some decadence of the crown may occur as mature plants become very old.
3. Mature – Mature plants with approximately less than 10% in the young age class. Mature plants range from above mid to maximum height for the species. This age class may also exhibit decadence in some plants.

Riparian obligate species density along the 100-meters between each transect is rated in quartiles using the same procedure for streambank stability. Density is the combination of species frequency along both sides of the stream. Calibration of the density estimate is gauged by density diagrams and/or periodically walking the stream edge and sampling where plants occur.

A combination of age and density classes is used to rate all riparian obligate species observed between each transect. For example, if a multi-age stand of willows occupies nearly all of the distance between transects on both sides of the stream, it would receive a rating of 8 on the data form, which equates to diverse-dense.

In addition to species information, record the width class along the stream that the riparian obligate species occupy. Place the applicable width class for each side of the stream on the data form.

Riparian Non-obligate Vegetation

Importance

Non-obligate species (also referred to as facultative species) such as softwood trees (conifers), hardwood trees (oaks) and certain woody shrubs can occur from stream edge to ridge lines. In the riparian area, a zone adjacent to streams where the microclimate is cooler and moister than upslope, these opportunistic species often occur in a mix with obligate species. As such, they supplement obligate species to complete the community structure and function of riparian areas. They can provide a great deal of shade since they can be much taller and often denser than obligate species. They often also provide the bulk of the large woody debris input to streams. LWD serves to provide stream habitat complexity. In addition, the non-obligate species can substantially contribute to stand structure diversity in the riparian area, enhancing arboreal habitat values along stream corridors.

Objectives of This Measurement

The objective is to characterize the amount, type and size of non-obligate vegetation along streams. This complements the obligate species characterization to provide an understanding of riparian corridor vegetation along streams.

Where to Take the Measurement

Identify non-obligate riparian species along the stream throughout the distance between 100-meter transects. Non-obligate vegetation can occupy a wide zone – from bankfull up to ridgeline. Make observations from bankfull upslope for about 100-150 feet. This will approximate the riparian microclimate zone in most cases as well as the potential height of many trees (though very old trees will occasionally be much taller). Observe tree species, stand structure and density.

It is important to focus on non-obligate species since they will occur in the riparian microclimate zone on over 90% of the distance along streams. The remaining cases where non-obligates are not usually present immediately adjacent to streams are meadows and stream segments with extensive bedrock outcropping.

A high percentage of the non-obligate species along streams will be conifers since they can exist in the streamside environment, and the variety of conifer species is adapted to nearly all elevation zones. Oaks can exist along streams at low to mid elevation. Shrubs can occupy all elevation zones.

How to Take the Measurement

While walking between each transect, observe all non-obligate species present as well as their age and density. At the end of each transect on the survey, record the non-obligate species and the age and density class observed during the 100 meters just walked.

Record the applicable species on the data form. For the most common type, mixed conifer (ponderosa, sugar and Jeffrey pines, Douglas and white fir, incense cedar), record the “M” code. For all other types record the appropriate code for the dominant and subdominant individual species. A subdominant species is defined as the second most common species as long as it consists of at least approximately 10% of the total number of non-obligate tree stems in the riparian corridor for the previous 100 meters. For example, if there are 200 stems of the mixed conifer group and 25 stems of lodgepole pine, the latter would be recorded as the subdominant species. If the second most common species is less than

10% do not list a subdominant. If there are two or more species greater than 10% list only the more common. The objective is to characterize the principal species rather than identify all that exist.

Note: If an individual or a few trees are noticed that are uncharacteristic for the area or elevation, record the species and a GPS location on the comment form. For example, if a hemlock, usually found at above 8,000 feet, is seen at 6,000 feet it should be recorded. In addition, lodgepole pines, usually found at elevations above about 6,000 feet, may be found well below that along streams.

After recording species, record the applicable age and density class, as described below.

Riparian area non-obligate species are categorized into the same three age classes as obligates species. However, the classes are defined by four layers that are visually as well as functionally distinguishable. Layer designations are as follows:

- Layer 1 – Seedlings, saplings and/or shrubs approximately less than 20 feet tall
- Layer 2 – Small to medium trees, approximately 20-100 feet tall
- Layer 3 – Large trees, approximately 100-150 feet tall
- Layer 4 – Very large, old trees, approximately greater than 150 feet tall

The non-obligate species age classes are as follows:

1. Young – Layers 1 and 2, with approximately less than 10% in layer 3 and 4.
2. Diverse – 3 or 4 layers present in any combination with at least about 10% of any one layer.
3. Mature – Layers 3 and 4 with less than about 10% of layers 1 and 2 present.

Riparian non-obligate species density along the 100-meters between each transect is rated in quartiles using the same procedure for obligate species. Density is the combination of species frequency along both sides of the stream. Calibration of the density estimate is gauged by density diagrams and/or periodically walking through the riparian zone and sampling canopy closure. This can be done using a densitometer or by conducting paced transects and recording canopy/no canopy by vertical observation at sample points.

A combination of age and density classes is used to rate all riparian non-obligate species observed between each transect. For example, a conifer stand with mix of layers 1, 2 and 3 and a density of 50-75% would receive a rating of 7 on the data form, which equates to diverse-moderate.

Snags

Importance

While live trees can fall along a stream and become LWD, the frequency of existing dead trees, or snags, may supplement near-term potential of streamside trees contributing to LWD. Snags are also preferred habitat for some bird and other species that are part of the streamside ecosystem and interact with aquatic biota.

Objectives of This Measurement

The objectives are to characterize the potential for large woody debris recruitment and gain an understanding of stand dynamics.

Where to Take the Measurement

This measurement is taken within the riparian zone over the 100-meter distance between transects.

How to Take the Measurement

Tally all snags encountered. A snag is a dead tree with a minimum diameter of 15'' that has retained a height of at least 1/3 of the tree prior to mortality. The height estimate can be calibrated by observing nearby live trees of the same species and similar dbh.

6. Measurements Taken at the Watershed Scale

Water Quality

Importance

The quality of water influences the composition and abundance of aquatic life and other beneficial uses of water. A synoptic sample of water can reveal basic characteristics of water quality.

Objectives of this Measurement

The objective is to obtain baseline water quality measurements of streams related to objectives of the inventory.

Where to Take the Measurement

Each flowing stream should be measured near the outlet of the watershed of the designated scale. Water tests should be taken from the fasting moving portion of a fast water habitat unit where water is well mixed.

How to Take the Measurement

Take the measurement with appropriate measuring devices. Attempt to take the measurement across watersheds in the same time window so results are comparable. For example, do not take measurements in one watershed in spring and another in the fall.

Measurement parameters should be determined based on the objective of each survey. All physical, biological and chemical parameters should be considered in relation to issues of importance in the watershed. For example, if trout are of management concern, temperature and dissolved oxygen may be reasonable parameters to measure.

Benthic Macroinvertebrates

Importance

Macroinvertebrates have been demonstrated to be useful indicators of water quality and habitat condition since they are sensitive to changes in water chemistry, temperature and physical habitat (Rosenberg and Resh 1993).

Objectives of this Measurement

To obtain a synoptic sample of water quality and habitat condition in the watershed.

Where to take the Measurements

The measurements should be taken at appropriate locations such as near outlets of streams of interest.

How to take the Measurements

The measurements should be taken using the protocol in the Pacific Southwest Region Stream Condition Inventory (SCI) (Frazier et al. 2005).

IV. References

Frazier J.W., K.B. Roby, J.A. Boberg, K. Kenfield, J.B. Reiner, D.L. Azuma, J.L. Furnish, B.P. Staab, S.L. Grant 2005. Stream Condition Inventory Technical Guide. USDA Forest Service, Pacific Southwest Region – Ecosystem Conservation Staff. Vallejo, CA 111 pp.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO. 376 pp.

V. Appendix - Example Forms

SSI Form 1: Transect & Channel Area Data

USDA Forest Service Pacific Southwest Region **Form 1**
Stanislaus Streamscape Inventory (SSI) Page 1 of 4
Transect & Channel Area Data **Reach #** 1

HUC 6 Name: Upper South Fork Tuolumne River District #: 54 Start Date: 07/18/2007
Stream: Rush Creek End Date: 07/18/2007
Observers: T. Weddle, K. Petersom, R. Wilson, E. Lancer

Start of Reach		
T 1S R 19E S 28	Datum: NAD83	Location Description: Rush Creek at confluence of
UTME: 245282	Zone: 10	SF Toulumne River
UTMN: 4190027	Waypt: 066	

At Each Transect				At Selected Transects				
Tran #	Gradient	Shade	Wetted Width	Bankful Width [1]	Flow [1] cfs	Flow [1] class	Temp [2]	Time [2]
1	30	95	2.05	3	1	1	15	1105
2	30	52	0.73	3.9				
3	31	87	2.35					
4	12	94	2.1					

Transect

Gradient: Record to the nearest whole % at each transect. (e.g.; 1, 3, 7).
Use the gradient classes below to determine reach breaks:
< 2% *4-10%*
2-4% *> 10%*

Streamflow: Record the measured flow (e.g.,; 1, 2.6 cfs) and the flow class per footnote 1 below.
Streamflow Class (cfs):
1 = < 2 *3 = 5-10*
2 = 2-5 *4 = > 10*

[1] Measure at all reach breaks and every 1600m for reaches exceeding that length.
[2] Record twice daily in the early AM and late PM.

Channel Area

Channel Form:
1 = Normal
2 = Incised
3 = Incised & widened
4 = Rejuvenating
Valley Form:
1 = Narrow
2 = Moderate
3 = Broad Alluvial (herb)
4 = Broad Alluvial (conifer)
Streambank Stability:
1 = < 25%
2 = 25-50%
3 = 50-75%
4 = > 75%
Substrate:
S = Sand (< 2mm) < 0.1"
G = Gravel (2-64mm) 0.1-2.5"
C = Cobble (64-256mm) 2.5-10"
B = Boulder (> 256mm) > 10"
R = Bedrock

Pool Tail Sed (%):
T = Thalwag
L = Left
R = Right

Channel Area													
Tran #	Pools								Channel Form	Valley Form	Bank Stability	Substrate	
	Pool #	Pool Tail Depth (m)	Max Pool Depth (m)	Total Pool Length (m)	Pool Tail Fine Sed % T	Pool Tail Fine Sed % L	Pool Tail Fine Sed % R	Pool Bed Fine Sed (m)				Dominant	Sub-Dominant
1	1	0.14	0.4	4.55	25	20	--	0	1	1	4	B	C
1	2	0.085	0.89	3.15				0					
2	1	0.04	0.5	5	27	7	41	1.15	1	1	4	R	B
3	no	Pools							1	1	4	B	R
4	1	0.1	0.95	7.2	5	7	8	0	1	1	4	R	B
4	2	0.08	0.96	4.2				0					
4	3	0.05	0.86	6.33				1.3					
4	4	0.1	0.6	5.5	15	1	22	0.6					

SSI Form 2: Riparian Area Data

USDA Forest Service Pacific Southwest Region **Form 2**
Stanislaus Streamscape Inventory (SSI)
Page 2 of 4

Riparian Area Data **Reach #** 1

Stream: Rush Creek Start/End Date: 07/18/07 / 07/18/07

Riparian Area Vegetation

Tran #	Obligate Vegetation: Species and Age/Density								Obligate Vegetation: Width		Non-obligate Vegetation: Left Bank			Non-obligate Vegetation: Right Bank			# of Snags
	AL	AZ	DW	BM					LB	RB	Dom	Sub	A/D	Dom	Sub	A/D	
1	7	5	--	7					2	2	M	H	6	M	H	6	5
2	7	5	5	6					2	2	M	H	6	M	H	5	5
3	5	9	--	5					2	2	M	H	6	M	H	5	6
4	5	1	5	5					1	1	M	H	6	M	H	5	4

Riparian Area Disturbances

Tran #	Dist Type	Length (m)	Avg Ht. (m)	GPS Waypoint	Zone	UTME	UTMN	Description/Notes (continue on Form 4 if needed)
1	6	50	20	78	11	245921	4188451	there are dispersed campgrounds to either side of Rush Ck.
								of Rush Ck. The one off of the LB is attached
								to the road 1S65Y. There is a bridge
								over gully (trib to Rush Ck.)
3	4	60	10	80	11	247639	4185623	OHV trail crosses creek, motercycle/quad

Riparian Area Vegetation

Obligate Spp:
AL = Alder
AS = Aspen
AZ = Azalea
BM = Bigleaf Maple
CW = Cottonwood
DW = Dogwood
WL = Willow
O = Other (describe in comments, Form 4)

Obligate Riparian Width:
1 = < 5m
2 = 5-15
3 = 15-30
4 = > 30

Non-Obligate Spp:[1]
M = Mixed Conifer
P = Ponderosa Pine
J = Jeffrey Pine
S = Sugar Pine
L = Lodgepole Pine
W = White Fir
D = Douglas Fir
R = Red Fir
C = Incense Cedar
H = Hardwood Trees
B = Shrub
O = Other (describe in comments, Form 4)

Age/Density:
1 = Young-Sparse (< 25%)
2 = Young-Light (25-50%)
3 = Young-Moderate (50-75%)
4 = Young-Dense (> 75%)
5 = Diverse-Sparse
6 = Diverse-Light
7 = Diverse-Moderate
8 = Diverse-Dense
9 = Mature-Sparse
10 = Mature-Light
11 = Mature-Moderate
12 = Mature-Dense

[1] *Record dominant spp. Code, and sub-dominant spp. code for spp. with >10 % of total stems in transect.*

Riparian Area Disturbances

Disturbance Type:
1 =Bare Slope
2 = Unclassified Road
3 = Landing/Skid Trail
4 = Motorized Trail
5 = Non-motorized Trail
6 = Dispersed Rec. Site
7 = Developed Rec. Site
8 = Grazing
9 = Other (describe)

Size Guide:
Minimum size approximately 50m^2
(e.g.; 10m x 5m = 50m^2)

SSI Form 3: Large Woody Debris & Aquatic Fauna Data

USDA Forest Service Pacific Southwest Region **Form 3**
Stanislaus Streamscape Inventory (SSI) Page 3 of 4
Large Woody Debris & Aquatic Fauna Data **Reach #** 1

Stream: Rush Creek Start/End Date: 07/18/07 / 07/18/07

Large Woody Debris

Transect #	1	2	3	4	4	
Single Pieces [1]	16	23	43	29	—	
Aggregates [2]	5	7,10,4,16,7	6-4-4-7	9-5-9-10-10	13-8	
Total Aggregate Pieces [3]	21	67	64	93	—	

[1] Tally each single piece of dead and down wood longer than ½ bankfull width that has at least a portion of its length within bankfull. Record in the Single Pieces box.
[2] Count the number of pieces in the aggregate and record this number in the Aggregates box. Separate aggregates with commas or dashes (e.g.; 4, 8, 5 or 4-8-5).
[3] Total the number of pieces in each aggregate for each transect (e.g.; 4+8+5=17). Record the number (e.g.;17) in the Total Aggregate Pieces box.

Aquatic Fauna

Tran #	Species	Lifestage	Tally Number of Aquatic Fauna by Size [4]					Habitat Type	Notes
			< 5 cm	5-10 cm	10-20 cm	>20 cm	Unknown		
			< 2 in	2-4 in	4-8 in	> 8 in			
1	Trout	NS		3	1			SLOW	
1	Trout	YOY					2	SLOW	
2	Trout	NS	3	2	2			SLOW	
2	Trout	YOY					3	SLOW	
3	Trout	NS			5	3		SLOW	
3	PSRE	NS	1					OTHER	Tree frog found on bank.
4	Trout	NS				3		SLOW	
4	TOAD	ADULT					1	OTHER	On log in muddle of stream.
4	Snake	ADULT				1		OTHER	Garter snake 18", found in grass
									on left bank. (see photo)

Aquatic Fauna Species

Amphibians
AMPHIBIAN: Amphibian (spp. unknown)
FROG: Frog (spp. unknown)
SALAMANDER: Salamander (spp. unknown)
TOAD: Toad (spp. unknown)
AMMA: Long-toed salamander
ANLU: Arboreal salamander
BAAT: California slender salamander
BUBO: Western toad
BUCA: Yosemite toad
PSRE: Pacific tree frog (chorus frog)
RAAD: California red-legged frog
RABO: Foothill yellow-legged frog
RACT Bullfrog
RAMU: Mountain yellow-legged frog
TATO: California newt

Reptiles
REPTILE: Reptile (spp. unknown)
LIZARD: Lizard (spp. unknown)
SNAKE: Snake (spp. unknown)

Reptiles cont.
CHBO: Rubber boa
CLMA: Western pond turtle
COCO: Racer
COTE: Sharptailed snake
CRVI: Western rattlesnake
ELCO: Northern alligator lizard
ELMU: Southern alligator lizard
ENES: Ensatina
EUGI: Gilbert's skink
EUSK: Western skink
LAGE: Common kingsnake
LAZO: California mountain kingsnake
PIME: Gopher snake
SCGR: Sagebrush lizard
SCOC: Western fence lizard
THCO: Sierra garter snake
THEL: Western terrestrial garter snake
THSP: Garter snake (spp. unknown)

Fish
FISH: Fish (spp. unknown)
TROUT: Trout (spp. unknown)
ONMY: Rainbow trout
SAFO: Brook trout
SATR: Brown trout
HESY: California roach

Other
OTHER: Other
CLAMS: Freshwater clams (spp. unknown)

Lifestage

EGG
TAD: Tadpole (amphibian only)
MET: Metamorph (amphibian only)
JUV/SUB: Juvenile/Sub-adult
ADULT
YOY: Young of Year (fish only)
NS: Not Specified or Unknown

Habitat Type

SLOW: slow water (pool)
FAST: fast water (e.g., riffle, run, glide)
OTHER: (e.g., bank, log) document other in the notes column.

Aquatic Fauna Tally

[4] Tally number of Aquatic Fauna by size class. If size is unknown, tally the number in the unknown box.

Conversion from Centimeters (cm) to Inches (in):
< 5 cm = < 2 in
5-10 cm = 2-4 in
10-20 cm = 4-8 in
> 20 cm = > 8 in

SSI Form 4: Photo Log & Comments

USDA Forest Service Pacific Southwest Region **Form 4**
Stanislaus Streamscape Inventory (SSI) Page 4 of 4
Photo Log & Comments **Reach #** 1

Stream: Rush Creek Start/End Date: 07/18/07 / 07/18/07

Tran #	Photo #	Waypoint	UTME	UTMN	Zone	Comments and Description
1	100-0124	77	245935	4188452	11	Reach break looking upstream
1	100-0114	67	245282	4190027	11	Point locality for car
1	100-0125	77	245935	4188452	11	Reach break looking downstream
1						Pool in T1 is directly below culvert outlet
2	100-1029					Culvert at Harden Flat Rd is alligned poorly
						with the stream.
4	100-0129					garter snake 18"

Photo Reminder: photograph (1) Reach breaks (up and down stream views); (2) disturbance sites; and (3) other notable attributes as identified.